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REPORT

OF

WILLIAM CHAPMAN, ENGINEER,

On the Means of

DRAINING THE LOW GROUNDS

IN THE VALES OF THE

DERWENT AND HERTFORD,

IN THE

NORTH AND EAST RIDINGS

OF THE

COUNTY OF YORK.

NEWCASTLE:

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1800.

BRITISH MUSEUM

REPORT

OF

WM. CHAPMAN

ON THE

DRAINAGE OF THE LOW GROUNDS

ON THE

DERWENT AND HERTFORD.

GENTLEMEN,

PURSUANT to your reſolutions, I examined the low grounds on the Hertford and Derwent, down to Malton, and the vale from Everley to the ſea, which the low ſtate of the rivers during the late froſt enabled me to do ſatiſfactorily. I was accompanied by Mr. Milbourne, who had ſurveyed the ground, prior to the year 1773; from whoſe general knowledge of the ſubject I received much uſeful information and aſſiſtance. The annexed engraved plan drawn from his ſurvey, Tuke's map of the county of York, and my own obſervations, will enable you more clearly to underſtand my deſcription of the ſtate of the country in queſtion, and the mode of proceeding which I ſhall recommend for your adoption.

The land propoſed to be drained falls under two diſtinct diviſions; in one of which the low ground extends moſtly for a great width, fluctuating from about half a mile to nearly two miles; but in the other, it is in general a narrow ſtrip, through which the river meanders from ſide to ſide. The latter diſtrict extends from Foul bridge downwards;

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and the other from thence upwards along the vale of the Hertford, to near the road from Hunmanby to Scarborough, and up the Derwent above its junction with the Hertford only about three-quarters of a mile; above which there is a third diſtrict occaſionally receiving great damage, as I ſhall hereafter deſcribe.

The two firſt, excepting from the junction of the Rye downwards, are covered with water in every moderate flood, and great part of them has little more than an eventual value dependent on the reſult of a drainage.

The third or laſt portion mentioned, that may be thus improved, is arable land; which occaſionally, as in October laſt, loſes or may loſe its crops by the overflowing of the Derwent: which, riſing in the mountains on the ſea-coaſt, where it forks into various branches up as many ſteep vales, comes down after heavy rains ſo ſuddenly and impetuouſly as to overflow both its banks and embankments below Ayton bridge, although it uſually runs about ſix feet under ſoil, and its embankments are 6 feet higher.

The damage to the crops is not the only one this part of the country ſuſtains; as, from the meandering and fluctuating ſtate of the river, the embankments, although placed at ſome diſtance, are ſubject to be undermined, and the expence of renewing them further off neceſſarily enſues.

The Derwent, after falling into the plain, expands itſelf at preſent ſo wide as to abate its current downwards, and alſo to retard it until after the floods of the Rye and the adjacent rivers have in general ſubſided: notwithſtanding which, their conjoint effect has ſometimes been ſuch as to ſweep away the crops on the borders of the Derwent down to near its junction with the Ouſe. Thus it appears that all the tract of land bordering on the Derwent would be much benefited by any plan that would ſend its mountain torrents a different courſe; the practicability of which has long been ſeen, as the features of the country point it out. On quitting the mountains this river paſſes through a narrow defile, immediately above which there is a broad gap in the ridge towards the ſea; through which opening nothing prevents the river from flowing but an extended plain gently riſing for upwards of a mile, and then declining to the ocean. This flat ground is nearly half a mile in width between the hills, and in its ſummit only riſes, according to the beſt information I could acquire, about eighteen inches above the higheſt floods in the river; which in this part do not exceed ten feet perpendicular height. This ſummit is a moory earth for about four feet in depth, and ſand for ſome feet below it. The fall from thence to the road from Hackneſs to Scarborough, and onwards to the Scalby road, appears to be moderate; and to within leſs than half a mile of the Whitby road ſeems not to be ſo ſteep as to make the water ungovernable that might be brought through this paſs; thenceforward it becomes ſteeper, and the vale narrower, ſo that the rivulet running through it has by its meandering torn down the brows of the high ground into precipices, and has in fact been more deſtructive than a river, whoſe reflection, if even left to itſelf, would not be ſo frequent. The propoſed courſe of the river would paſs ~~the~~ two mills above the Whitby road; and below it is a mill in diſuſe, and one in good repair cloſe to the ſea, near to which the vale on both ſides is bounded by rocks.

In the eſtimate for this new outlet for the floods of the Derwent I have allowed for the expence that may be neceſſary to ſecure the mills; which, as they are ſituated on a ſmall ſtream, will, I conceive, receive benefit from the propoſed work; as in a moderate ſtate of the river, when they might otherwiſe be in want of water, they may receive all the ſurplus of the Derwent above what is requiſite for the mills below, viz. the Forge, Ayton mill, and the two mills at Malton.

Through want of Mr. Brindley's levels, which I did not obtain, I cannot ſay preciſely where the river ought to be taken off;—it may be either at the bend of the river north of Everley, (marked 2 in the plan) where Mr. Gray, agent to Sir Richard B. Johnſtone, informed me it was originally propoſed to be taken off; or it may be where the dotted line is drawn, about three-quarters of a mile lower down, where the riſing land borders on the low ground.

In this ſituation the river being raiſed by a weir, an embankment parallel to the riſing ground may conduct it into a cut through the plain between the hills already deſcribed. I propoſe the weir to have a ſluice through it, of ſufficient opening to ſupply the mills on the Derwent, when the penned up water is level with the overflow at the head of the off-take channel. Thus, whenever the river riſes, it will, in general, benefit the mills in both courſes; thoſe on the Derwent by not ſubjecting them to back-water, and on Scalby beck by ſupplying them, as before mentioned, with water, when they might otherwiſe want it. They are alſo ſo circumſtanced as to ſuffer little from back-water, becauſe they are over-ſhot mills, and from the new courſe having the ſame fall in about four miles as the river now has in more than fifty, ſo as to paſs off both in leſs time and with leſs depth. The eſtimate, including bridges for the high roads, two communication bridges, value of land, &c. amounts, as by the annexed ſummary, to a little more than ſix thouſand five hundred pounds. For want of accurate levels through the ſummit, and a certainty of the nature of the ground, it can only be expected to be near the amount; but founded on the data I have mentioned, it is, I believe, ſufficiently high.

The ſudden overflowing of the Derwent being removed, the third deſcribed diſtrict becomes exempted from the injuries it has experienced; and the two lower diſtricts become capable of being drained and made arable land, by following the means indiſpenſably requiſite to perfect drainage under their predicaments, viz. by embanking the rivers to prevent their overflowing, by embanking the rivulets that communicate with them, by conducting into thoſe rivulets through catch-water * drains on the verge of the uplands all the waters and ſprings that can be collected; ſo that nothing fall into the low lands but water immediately from the heavens, which, conſidering the length of time that its exit muſt frequently be prevented, will of itſelf be ſufficient on many occaſions to be got rid of; and, finally, to carry off by drains the water from the low grounds, paſſing it by tunnels under the rivulets, and diſcharging it into the rivers at as low a point as conveniently can be had. This for the upper diſtrict above Foul bridge, may with propriety be at Yedingham bridge, nearly two miles lower, and therefore all the line from Muſton and Ayton, downwards to this point, poſſeſſes the means of drainage independently of the diſtrict below.

Throughout the whole of this upper diſtrict, the fall, according to Mr. Milbourne's levels, appears to be upwards of eighteen inches per mile, if taken in a direct line; which is amply ſufficient for the purpoſes of drainage, and the paſſage of the rivers; particularly if their courſe be ſtraighten-

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* The fence ditches that are near the foot of the riſing ground, and lie parallel to its range, or nearly so, may generally be made to anſwer throughout a conſiderable portion of the whole extent.

ed; which they admit of without expence, becauſe the excavation of ſufficient channels for their water in a mean ſtate will fall ſhort of forming the embankments requiſite to confine them in floods, even admitting a conſiderable foreland between the river and embankments: and the reſidue of the embankment will have to be formed from the chief, or mother * drains; which, from this cauſe, muſt run parallel to the new courſe of the rivers, and about two or three yards diſtant from the foot of the embankments.

According to Mr. Milbourne's plan, the old and propoſed courſes of the Derwent, above Yedingham bridge, will be as under :—

	Old Course.		*New Course.*	
	miles.	fur.	miles.	fur.
S. E. angle of Derwent to its propoſed junction with the Hertford		7½		4
To Yedingham bridge - - -	9		6	3
	9	7½	6	7

Thus, by the new courſe, nearly one third of the diſtance will be ſaved, which will give a quicker paſſage to the waters, and a comparatively leſs height upon the banks, from two obvious cauſes, viz. from the ſame fall taking place in a much ſhorter length, and from the river being freed from thoſe checks it receives in every deviation from its courſe, which from the ſuddenneſs of its bends in the preſent inſtance are very material. The deviations of the Hertford from a ſtraight courſe are conſiderable; but inferior to thoſe on the Derwent, whoſe line of direction I have propoſed to lead further from its original courſe than I ſhould have done had not the extenſive property of individuals enabled that deviation to take place without the neceſſity of additional bridges. In the eſtimate I have calculated on a high road bridge over the Hertford of 24 feet ſpan, on the road from Stockton to Seamer; and on three bridges over the Derwent, each conſiſting of a 24 feet arch, and two ſmaller ones, and correſpondent with Ganton-hay, Sherbourn, and Foul bridges. The new courſe of the Derwent I have laid through the Eaſtern reach of Brompton cut, as ſo far ſaving the occupation of new land and diviſion of property; as being alſo ſtraighter than any other adviſeable, and nearer the ſide where the principal rivulets come from. The quantity of low ground in this diviſion of the drainage, through which the rivers in a low ſtate run for a great extent, little below the ſurface of the land, is, according to Mr. Milbourne, 9450 acres, excluſive of what apparently may be 1000 acres more on the N. E. branches of the Hertford, which he did not ſurvey. The expence of draining the whole I have eſtimated at rather more than eleven thouſand pounds. I avoid entering into the detail of the propoſed widths of the rivers in different places, the extent of the forelands, form of the banks, ſize of the drains, &c. as they will be found in the written eſtimate: I therefore ſhall only ſay that they are calculated to be accordant and ſuperior to the bodies of water that there is reaſon to believe will paſs down them, and the velocities with which they can run.

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* Besides these, there will be transverse drains, formed by the embankments of the rivulets, which will be the only public drains wanted. Wherever the smaller rivulets, or a collection of them, are carried in across the low ground, it should be done, wherever convenient, along the boundary line of two townships or distinct properties. The present bed of the Hertford, from near its proposed junction with the Derwent to its present one above Ganton-hay bridge, and the Sherbourn cut from thence will prove useful drains, communicating with the mother and transverse drains,

From the information I have received, combined with my own obſervations, I think it probable, even after the floods of the Derwent are wholly or principally turned off to the ſea, that the river at Yedingham bridge may occaſionally remain ſeveral days above the level of the low grounds; in which caſe the rain water that falls on the extenſive diſtrict of low ground above, will not find a vent into the river; and after filling the drains in its lower extremity muſt neceſſarily overflow progreſſively the narrow ſlip of low land towards Foul bridge, to which I preſume it can rarely extend, as the riſe is two feet and a half, and the ground to be covered about 100 acres, of nearly a uniform width. If it ſhould happen to be unſafe to cultivate this ſmall portion of the low ground, it will receive an equivalent advantage from being occaſionally flooded with water, enriched by the manure and fine particles of the ſoil of the tract of low ground above it, which will be in a courſe of cultivation. This circumſtance leads me to conſider, that many may complain of being ſhut off from the advantage of being flooded by the rivers. This aſſumed advantage, if it have been one, has been very precarious, as never being under the controul of the party wiſhing to benefit from it; and alſo becauſe the mountain waters of the Derwent are rather of a ſterile than enriching quality. The command of water that can be let on and taken off at pleaſure is highly advantageous, and more particularly ſo if enriched with manure and ſoil. What I have to propoſe will admit of this proceſs; but it will require to be done under certain regulations, and not ſolely at the will of the individual.

The rivulets embanked acroſs the vale will divide the low ground into various diſtricts, each having no communication with the other, below the level of the higheſt floods, excepting by the tunnels of the mother drains paſſing under thoſe rivulets, upon which draw-gates may be fixed capable of cloſing the openings: thus, by means of other draw-gates or ſluices through the banks of the river, the turbid water of floods may be let over the whole ſurface of any of thoſe great ſubdiviſions independently of the reſt, and afterwards drawn off by the mother drain on the ſubſiding of the flood, without any inconvenience to the ſubdiviſions below it, and only a partial one, if any, to thoſe above, which would at their lower extremity be flooded by the rain waters, in the manner that I have ſaid the low lands between Yedingham and Foul bridges will ſometimes be.

It may alſo be eligible to flood the ground when the river, although in a flooded ſtate, does not riſe ſufficiently above the forelands. In this caſe nothing more is requiſite than to pen up the river under the bridges, or elſewhere, until it riſes to a ſufficient height, or to cloſe up the mouths of the rivulets; either of which may be done by a ſpecies of ſtop-gates capable of being raiſed or let down at pleaſure, ſo as not to impede the paſſage of floods.

The purpoſes of irrigation may be anſwered by turning in ſtreams from the catch-water drains, particularly when they are charged with ſoil; or the rivulets themſelves, on their entrance into the low grounds. What I have before ſpoken of, may be called flooding, which can be of little ſervice but when the water is turbid.

In eſtimating the quantity of land, I have allowed for the ſurface opening of the cut, and of the drains, without any deduction for the old bed of the river, which will compenſate for any error I may have fallen into as to the value of the land.

Between the river and the mother drains there will be on an average, including the foreland, and the embankment and ſpace between its foot and the drain, a width of about 18 yards, which never ſhould be cultivated. More than half of this will be liable to occaſional floods; but from the water being of an enriching quality, and not impoveriſhed * by the mountain ſtreams, this land may probably be as valuable as the reſt. If heavy cattle be admitted upon it, they will be liable to injure the banks of the river, which I recommend to be cut with as flat a ſlope as 2½ baſe to 1 in height, to prevent their being undermined: they will conſequently be covered with aquatic or other graſſes from the low water level of the river upwards: the embankment may alſo have the ſame ſlope, unleſs where the mother drain and half the excavation of the bed of the river, will form it flatter: its height I propoſe to be 5 feet with 2 feet width of top; and where there is a want of earth, that its ſlope to the country be 2 to 1. The ſpace between the drain and the river ſhould be under the controul of proper laws; and I preſume no inconvenience would ariſe by limiting the grazing of it to ſheep and calves not exceeding a year old, viz. that after May-day, or any given period, no calves of the preceding year ſhould be admitted.

Having now ſaid all that appears material on the diſtrict above Yedingham bridge, much of which will apply generally to what lies below, I ſhall proceed to the particular deſcription of that part.

From Yedingham bridge down to near the junction of the Rye, the low grounds have moſtly been flooded, or the water near their ſurface, ſince July laſt; from thence downwards the ſhores are conſiderably higher, excepting low ſlips near the foot of the riſing lands; which circumſtances clearly prove, that the floods of the Rye differ from thoſe of the

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* The water, both from this cauſe and its being confined to far leſs extent than formerly, will progreſſively raiſe the forelands, and make them leſs ſubject to be flooded. The water-way for the floods will then be reduced, and the remedy at that period, which may be diſtant, will be to raiſe the embankment by earth from the verge of the river.

Derwent in a very eſſential reſpect, viz. in its water being thick and muddy, and leaving depoſits on its ſhores; from which cauſe the combined river downwards is in its uſual ſtate ſeveral feet within its banks, excepting where penned up by weirs; which, although apparently detrimental to drainage, are not injurious in times of flood; and no further ſo at other times than as they throw up the water too near the ſurface of the adjacent lands, which is remediable by an embankment and an inner drain diſcharging itſelf below the weirs.

By Mr. Milbourne's levels, the fall from Yedingham bridge to Old Malton mill-dam, a length of 11 miles 3 furlongs by the preſent courſe of the river, and of 9 miles 3 furlongs by the propoſed ſtraightening of the channel above the Rye, is but 6 feet 6 inches; a ſmall fall for that diſtance, but we have to add to it the fall of Old Malton mill-dam, which in the low ſtate of the river is almoſt 3 feet: thus we have nearly 9 feet 6 inches, which is about one foot fall per mile; and one mile lower, where the diſcharge of the drains is propoſed to be, we have 5 feet fall at New Malton mill-dam, making on the whole nearly 17 inches per mile; which altho' leſs than above Yedingham is ſufficient for the purpoſe of drainage.

The means I ſhall recommend, as the vale of low ground is in general very narrow and bounded by land riſing rather abruptly, and the courſe by the ſouthern ſhore is the ſhorteſt, will be to form a new cut for the river on that ſhore, near the foot of the riſing ground, leaving ſufficient * foreland on that ſide, and forming the embankment on the outer ſide only.

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* If the low ground in any particular place ſhould form a deep indenture, and be conſiderable as to quantity, it may be embanked on that ſide alſo, and communicate at no great expence with the mother drain on the other ſide, by a ſmall tunnel under the new courſe of the river

To ſave the charge of diſtant wheeling, this embankment may be near the verge of the channel excavated for the river, which will partly compenſate for the additional charge of laying the earth all on one ſide only. The mother drain, embanked rivulets, and tunnels under them, will of courſe be wanted on the north ſide only. A conſequent inconvenience however attends this plan, which is that the low land belonging to the ſouth ſide will for the greateſt part be totally cut off from it without the help of communication bridges; and if they be numerous it may be adviſeable to keep the middle, and nearly divide the property, either of which would cauſe the expence to become heavy.

I have calculated upon four communication bridges, and upon the channel for the river being 5 feet deep, and of a mean width of 44 feet on the ſurface of the excavation, and 19 feet bottom. Alſo on the banks below as well as above the junction of the Rye being raiſed to 6 feet, and with the ſlopes before mentioned.

The propoſed new channel ceaſes before the junction with the Rye, becauſe from the river being thenceforward conſiderably within ſoil, as well as increaſing in magnitude, it becomes too expenſive to alter it: all that can eaſily be done will be to remove the embankments conſiderably within the points on the bends of the river, ſo as to admit the water when it riſes high to take a ſtraight courſe. This part of the Derwent, after its combination with the Rye, is in length 3 miles and 3 furlongs to Old Malton mill-dam, and could not be materially ſhortened: It is not however liable to change its courſe, becauſe on the firſt coming down of the floods, which is the period in which they undermine the banks, they find the channel full from the back-water of the mill, and when the floods riſe to their height, as every attentive obſerver muſt have ſeen, the ſite of the weirs will not be obſervable by any appearance on the ſurface of the water, and therefore no ſenſible impediment enſues from them.

This obſervation is only applicable where the floods ſurmount the dams conſiderably, or their length materially exceeds the width of the river, both which circumſtances are attendant on the weirs of Malton mills.

The mother drain which I have mentioned will have to paſs under the Rye, and terminate with a clough below New Malton mill; and on the north ſide below Rillington moor a drain ſhould paſs through the ſlade, or hollow of the low ground already deſcribed near the foot of the riſing land, and after going under Scagglethorpe beck, &c. terminate in a clough below the ſouth end of the weir of New Malton mill.

The expence of the whole of the works which I have enumerated for this diſtrict, below Yedingham bridge, amounts, by my eſtimate, to 8087l.; and the quantity of low land, below the above bridge on the Derwent, and How bridge over the Rye, amounts, by the old ſurvey of Mr. Milbourne, only to about 1300 acres, upon which the above expence would fall heavy. It therefore, although included under the ſame act as to the powers of drainage, would be eligible to poſtpone carrying any thing into execution, until after the Derwent ſhould be carried to ſea, and the works above Yedingham bridge finiſhed; that it might be aſcertained how far a leſs channel for the river, down to the Rye, would be ſufficient, and lower embankments further down; which latter will much depend on the weſtern drainage taking place.

In this event the preſent embankments, near the junction of the Rye and Derwent particularly, will probably be ſufficient; becauſe the moſt efficacious groundwork for the drainage of the low lands on the former river, will be to make a flood channel for it, from above Newſham mill-dam to below that of Old Malton, a diſtance of about 4½ miles, in which the ground is very ſuitable, and the fall will be at leaſt 15 feet, as according to Mr. Eaſtburn's levels, taken for Lord Fitzwilliam, the riſe from the Rye, at Ryton bridge, to the crown of Newſham mill-dam, was 12 feet 3 inches; to which add 3 feet fall of Old Malton mill-dam, and allowing nothing for the riſe from thence to Ryton bridge, we have more than the fall ſtated: there is, however, to be deducted what the water would riſe *below* Malton mill-dam, beyond what it would *above* the dam of Newſham mill; againſt which may be placed the riſe to Ryton, which would be conſiderable, although the water might be penned back that far, as the diſtance is at leaſt 8 miles, and the Rye very crooked.

The propoſed ſhort courſe of 4½ miles in place of the very circuitous and interrupted one by the river, of upwards of 11 miles, will paſs off the floods of the Rye ſo much more eaſily as to prevent its riſing to the extent it now does, which is greater than that of the Derwent below its junction, as I have had an opportunity of obſerving.

At noon on Monday the 6th of January, the Rye was within nine inches of filling the ſide arches of Newſham bridge, about 3 feet above the level of the adjoining land from which it was embanked; and, as I was informed, about 6 feet above the mill-weir, the fall of which is 6 feet, and therefore 12 feet riſen from its low ſtate, which is 9 feet within its natural banks. The flood at Old Malton, it appears, did not reach its height until the day following, near midnight, and had then only riſen 6 feet 3 inches below the dam. Theſe facts clearly prove the efficacy and neceſſity of this previous ſtep for the weſtern drainage, and that of courſe the eſtimated expence of the drainage below Yedingham bridge, includes charges that need not be incurred until that of the north-weſtern country take place, with which this will be properly connected, from the further circumſtance of its affording the beſt outlet for the drainage of the low lands on the Coſta.

I am,

GENTLEMEN,

Your obedient humble Servant,

WILLIAM CHAPMAN.

Newcastle, Jan. 16th, 1800.

To the Proprietors of the low grounds on the Derwent, Hertford, &c.

SUMMARY OF THE ESTIMATES.

New courſe for the floods of the Derwent from Everley to the ſea.

Earth work	£.4039	
Bridges, weir, overflow, and ſecuring of mills	1205	
Land	441	
	5685	
Superintendence, temporary damage to land, incidents, &c. 15 per cent.	853	
		£. 6538

Drainage of the low grounds, on the Hertford and Derwent above Yedingham bridge.

New courſe of the Derwent, Hertford, and the brooks communicating with them	4140	
Drains, &c.	2451	
Bridges, tunnels, cloughs, &c.	2207	
Land	960	
	9758	
Superintendence, &c. &c. 15 per cent.	1464	
		£.11,222
		£.17,760

Drainage of the low grounds on the Derwent and Rye, below Yedingham bridge and How bridge, down to New Malton mill.

New courſe of Derwent, above its junction with the Rye	2891	
Embankment below How bridge, and on the old courſe of the Derwent and Rye	1677	
Drains	693	
Tunnels, cloughs, and bridges	1077	
Land	694	
	7032	
Superintendence, temporary damage to land, incidents, &c. 15 per cent.	1055	
		£. 8087

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